

Pb Free Plating Product

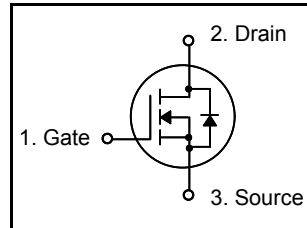
## 20N50B



### 20A,500V Heatsink N-Channel Type Power MOSFET

#### Features

- $R_{DS(on)}$  (Max 0.24  $\Omega$ )@ $V_{GS}=10V$
- Gate Charge (Typical 130nC)
- Improved dv/dt Capability
- High ruggedness
- 100% Avalanche Tested



$BV_{DSS} = 500V$

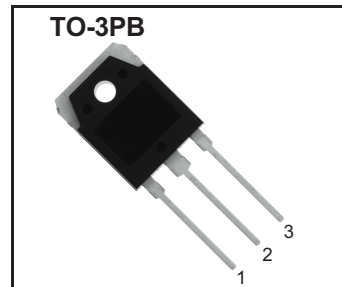
$R_{DS(ON)} = 0.24 \text{ ohm}$

$I_D = 20A$

#### General Description

This N-channel enhancement mode field-effect power transistor using THINKI Semiconductor advanced planar stripe, DMOS technology intended for off-line switch mode power supply.

Also, especially designed to minimize  $r_{ds(on)}$  and high rugged avalanche characteristics. The TO-3PB pkg is well suited for adaptor power unit and small power inverter application.



#### Absolute Maximum Ratings $T_C = 25^\circ C$ unless otherwise noted

Symbol	Parameter	Value	Units
$V_{DSS}$	Drain-Source Voltage	500	V
$I_D$	Drain Current - Continuous ( $T_C = 25^\circ C$ ) - Continuous ( $T_C = 100^\circ C$ )	20	A
		12.5	A
$I_{DM}$	Drain Current - Pulsed (Note 1)	80	A
$V_{GSS}$	Gate-Source Voltage	$\pm 30$	V
$E_{AS}$	Single Pulsed Avalanche Energy (Note 2)	1050	mJ
$I_{AR}$	Avalanche Current (Note 1)	20	A
$E_{AR}$	Repetitive Avalanche Energy (Note 1)	23.5	mJ
dv/dt	Peak Diode Recovery dv/dt (Note 3)	4.5	V/ns
$P_D$	Power Dissipation ( $T_C = 25^\circ C$ ) - Derate above $25^\circ C$	235	W
		1.88	W/ $^\circ C$
$T_J, T_{STG}$	Operating and Storage Temperature Range	-55 to +150	$^\circ C$
$T_L$	Maximum lead temperature for soldering purposes, 1/8" from case for 5 seconds	300	$^\circ C$

#### Thermal Characteristics

Symbol	Parameter	Typ	Max	Units
$R_{\theta JC}$	Thermal Resistance, Junction-to-Case	--	0.53	$^\circ C/W$
$R_{\theta CS}$	Thermal Resistance, Case-to-Sink	0.24	--	$^\circ C/W$
$R_{\theta JA}$	Thermal Resistance, Junction-to-Ambient	--	40	$^\circ C/W$

## Electrical Characteristics

$T_C = 25^\circ\text{C}$  unless otherwise noted

Symbol	Parameter	Test Conditions	Min	Typ	Max	Units
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### Off Characteristics

$BV_{DSS}$	Drain-Source Breakdown Voltage	$V_{GS} = 0\text{ V}, I_D = 250\ \mu\text{A}$	500	--	--	V
$\frac{\Delta BV_{DSS}}{\Delta T_J}$	Breakdown Voltage Temperature Coefficient	$I_D = 250\ \mu\text{A}$ , Referenced to $25^\circ\text{C}$	--	0.55	--	$\text{V}/^\circ\text{C}$
$I_{DSS}$	Zero Gate Voltage Drain Current	$V_{DS} = 500\text{ V}, V_{GS} = 0\text{ V}$	--	--	10	$\mu\text{A}$
		$V_{DS} = 400\text{ V}, T_C = 125^\circ\text{C}$	--	--	100	$\mu\text{A}$
$I_{GSSF}$	Gate-Body Leakage Current, Forward	$V_{GS} = 30\text{ V}, V_{DS} = 0\text{ V}$	--	--	100	nA
$I_{GSSR}$	Gate-Body Leakage Current, Reverse	$V_{GS} = -30\text{ V}, V_{DS} = 0\text{ V}$	--	--	-100	nA

### On Characteristics

$V_{GS(th)}$	Gate Threshold Voltage	$V_{DS} = V_{GS}, I_D = 250\ \mu\text{A}$	2.0	--	4.0	V
$R_{DS(on)}$	Static Drain-Source On-Resistance	$V_{GS} = 10\text{ V}, I_D = 10.0\text{ A}$	--	0.2	0.24	$\Omega$
$g_{FS}$	Forward Transconductance	$V_{DS} = 50\text{ V}, I_D = 10.0\text{ A}$ (Note 4)	--	18	--	S

### Dynamic Characteristics

$C_{iss}$	Input Capacitance	$V_{DS} = 25\text{ V}, V_{GS} = 0\text{ V},$ $f = 1.0\text{ MHz}$	--	4590	6000	pF
$C_{oss}$	Output Capacitance		--	380	460	pF
$C_{riss}$	Reverse Transfer Capacitance		--	60	80	pF

### Switching Characteristics

$t_{d(on)}$	Turn-On Delay Time	$V_{DD} = 250\text{ V}, I_D = 20\text{ A},$ $R_G = 25\ \Omega$	--	50	120	ns	
$t_r$	Turn-On Rise Time		--	150	310	ns	
$t_{d(off)}$	Turn-Off Delay Time		(Note 4, 5)	--	380	770	ns
$t_f$	Turn-Off Fall Time		--	180	370	ns	
$Q_g$	Total Gate Charge		$V_{DS} = 400\text{ V}, I_D = 20\text{ A},$ $V_{GS} = 10\text{ V}$	--	130	170	nC
$Q_{gs}$	Gate-Source Charge	(Note 4, 5)	--	20	--	nC	
$Q_{gd}$	Gate-Drain Charge		--	45	--	nC	

### Drain-Source Diode Characteristics and Maximum Ratings

$I_S$	Maximum Continuous Drain-Source Diode Forward Current	--	--	20	A	
$I_{SM}$	Maximum Pulsed Drain-Source Diode Forward Current	--	--	80	A	
$V_{SD}$	Drain-Source Diode Forward Voltage	$V_{GS} = 0\text{ V}, I_S = 20\text{ A}$	--	--	1.4	V
$t_{rr}$	Reverse Recovery Time	$V_{GS} = 0\text{ V}, I_S = 20\text{ A},$	--	480	--	ns
$Q_{rr}$	Reverse Recovery Charge	$dI_F / dt = 100\text{ A}/\mu\text{s}$ (Note 4)	--	7.7	--	$\mu\text{C}$

#### Notes:

1. Repetitive Rating : Pulse width limited by maximum junction temperature
2.  $L = 5.1\text{ mH}, I_{AS} = 20\text{ A}, V_{DD} = 50\text{ V}, R_G = 25\ \Omega$ , Starting  $T_J = 25^\circ\text{C}$
3.  $I_{SD} \leq 20\text{ A}, di/dt \leq 200\text{ A}/\mu\text{s}, V_{DD} \leq BV_{DSS}$ , Starting  $T_J = 25^\circ\text{C}$
4. Pulse Test : Pulse width  $\leq 300\ \mu\text{s}$ , Duty cycle  $\leq 2\%$
5. Essentially independent of operating temperature

## Typical Characteristics

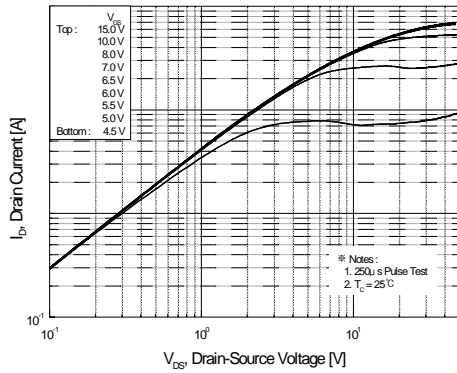


Figure 1. On-Region Characteristics

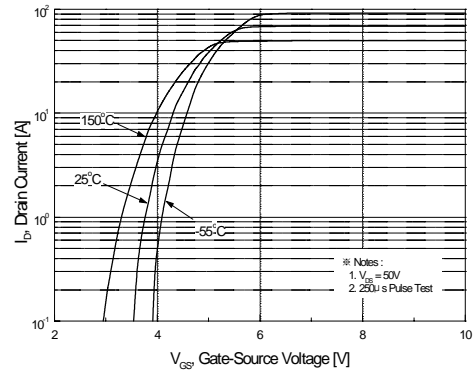


Figure 2. Transfer Characteristics

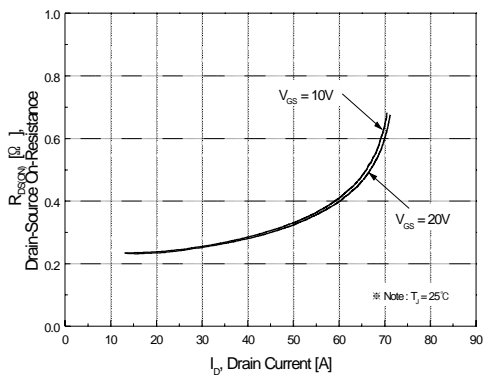


Figure 3. On-Resistance Variation vs Drain Current and Gate Voltage

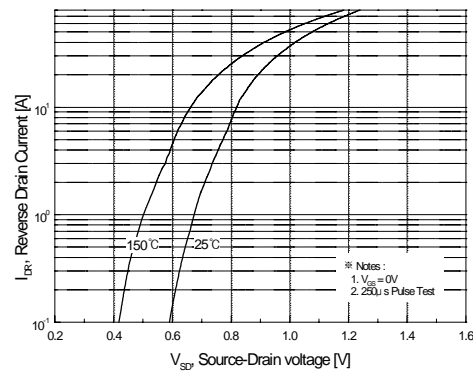


Figure 4. Body Diode Forward Voltage Variation with Source Current and Temperature

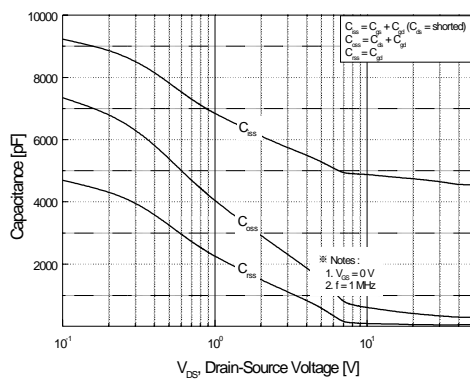


Figure 5. Capacitance Characteristics

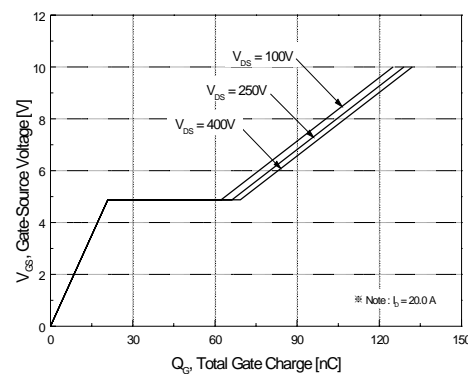
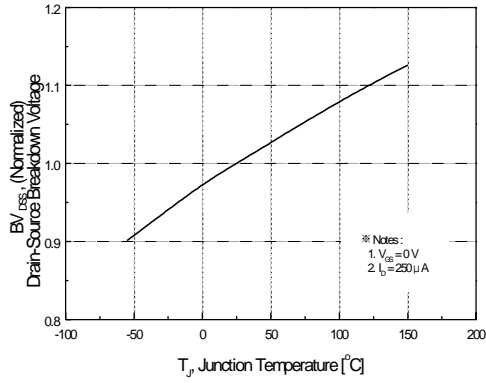
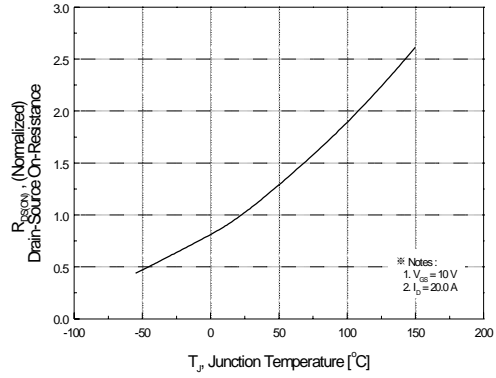


Figure 6. Gate Charge Characteristics

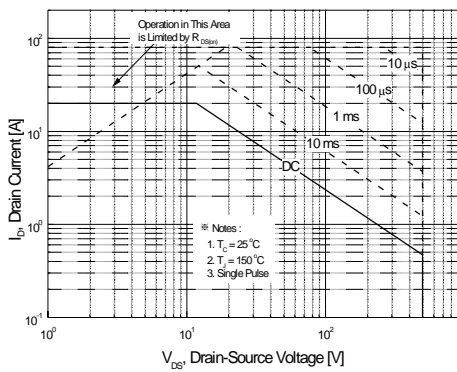
## Typical Characteristics (Continued)



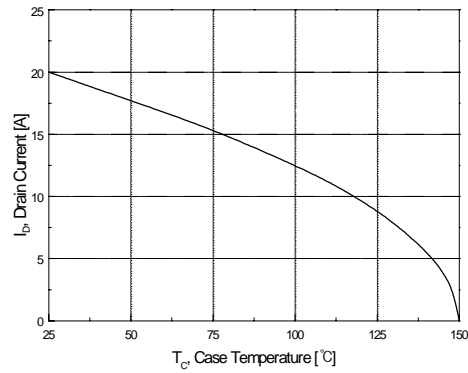
**Figure 7. Breakdown Voltage Variation vs Temperature**



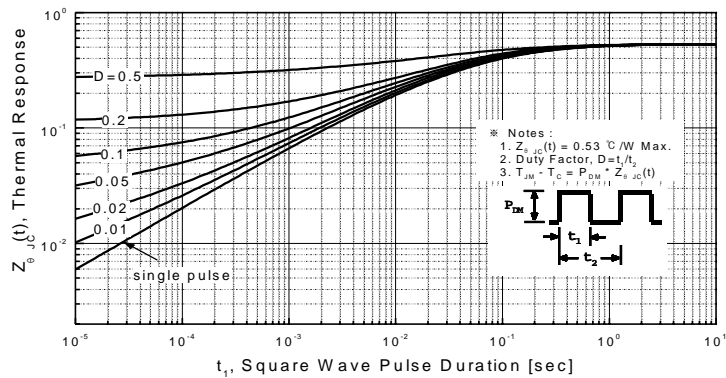
**Figure 8. On-Resistance Variation vs Temperature**



**Figure 9. Maximum Safe Operating Area**

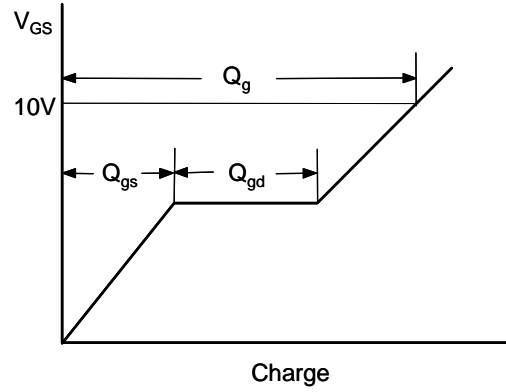
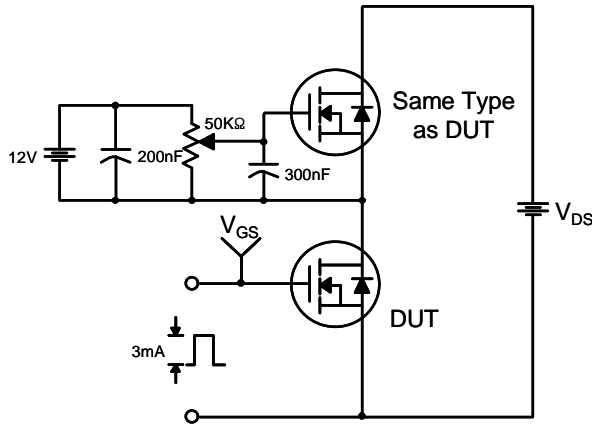


**Figure 10. Maximum Drain Current vs Case Temperature**

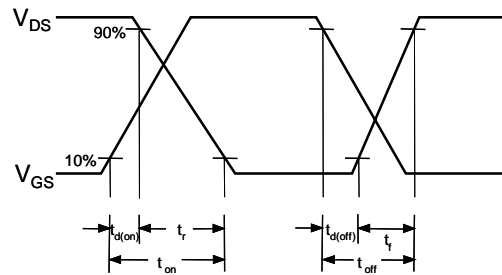
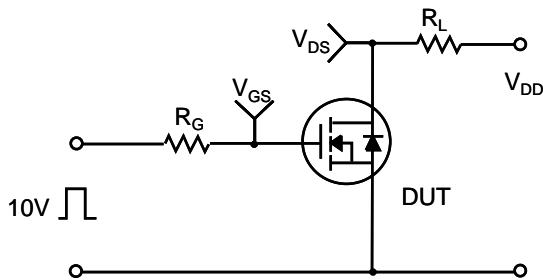


**Figure 11. Transient Thermal Response Curve**

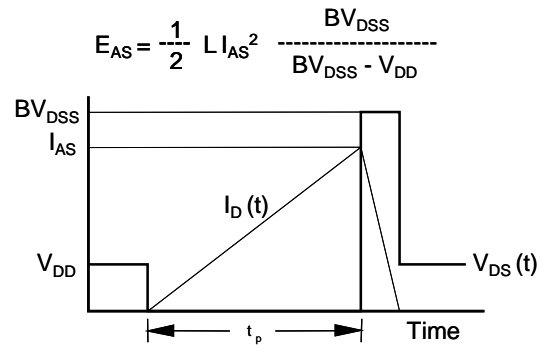
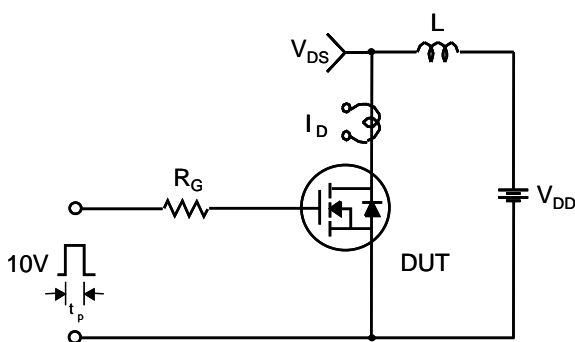
Gate Charge Test Circuit & Waveform



Resistive Switching Test Circuit & Waveforms



Unclamped Inductive Switching Test Circuit & Waveforms



Peak Diode Recovery dv/dt Test Circuit & Waveforms

